

Inonotus Root and Butt Rot of Pines in Florida¹

E. L. Barnard²

INTRODUCTION: To many, pine root disease is synonymous with annosum root disease (= annosus root rot) caused by *Heterobasidion annosum* (Fr.:Fr.) Bref. [syn. *Fomes annosus* (Fr.:Fr.) Cooke]. This is an oversimplification, however, because a variety of pathogenic fungi commonly infect roots of pines (Barnard 1988, 1999; Barnard *et al.* 1985; Barnard *et al.* 1991; Barnard and Meeker 1995; Blakeslee and Oak 1980, Hanula *et al.* 2002; Sinclair *et al.* 1987). The occurrence and impacts of these pathogens and their associated diseases vary with host pine species, soil types, tree ages, and forest and shade tree management practices. In Florida, *Inonotus circinatus* (Fr.) R. L. Gilbertson (= *Polyporus tomentosus* Fr.:Fr. var. *circinatus* (Fr.) Sartor and Maire), a cause of “red root and butt rot” of various conifers (Boyce 1961; Whitney 1977; Patton and Myren 1970; Sinclair *et al.* 1987), is a predominant pathogen in diseased roots of sand pine [*Pinus clausa* (Chapm.) Vasey] and a common colonizer of slash pine (*P. elliottii* Engelm.) roots (Barnard *et al.* 1985, 1991). Similar associations are known in other southeastern states (Boyce 1963, 1965, 1967; Cram and Oak, USDA Forest Service – personal communication; Sinclair *et al.* 1987). *I. circinatus* is particularly common on slash pine associated with basal fusiform rust galls/ cankers (Boyce 1963, 1965, 1967) and on old growth sand pine (Barnard *et al.* 1985).

RECOGNITION OF THE DISEASE: Inonotus root and butt rot can be detected and often confirmed in the field through observation of a variety of indicators. Infected trees may exhibit one or more of the following symptoms: basal resinosis, crown-thinning, windthrow, or outright mortality (Fig. 1). Infected wood tissues in tree bases or roots are often resin-soaked or resin-impregnated. (**Caution:** Resin-soaking/impregnation is a “generic” symptom in traumatized



Fig. 1. External symptoms of root and butt infections in *Pinus clausa* by *Inonotus circinatus*. A) Basal resinosis and resin-impregnation of xylem. B) Crown-thinning and mortality in old growth trees. C) Windthrow. (Photography credit: E. L. Barnard).

¹ Contribution No. 738, Bureau of Entomology, Nematology, Plant Pathology – Plant Pathology Section

² Forest Pathologist, Divisions of Forestry and Plant Industry, FDACS, P.O. Box 147100, Gainesville, FL 32614-7100.

pine wood tissues. This symptom may also indicate mechanical or fire injury, insect infestation or injury, or infection by other root disease fungi.) Advanced wood decay caused by *I. circinatus* is a typical “white pocket rot” (Boyce 1961; Sinclair *et al.* 1987; Whitney 1977). This decay pattern (Fig. 2) distinguishes *Inonotus* root and butt rot from rots caused by other basidiomycetous root/butt rot pathogens such as *H. annosum* (causing a “white stringy rot”) and *Phaeolus schweinitzii* (Fr.:Fr.) Pat. (causing a “brown cubical rot”). Under suitable conditions of temperature and moisture, *I. circinatus* produces terrestrial and centrally stipitate (stemmed) or sessile basidiocarps (Fig. 3) at or near the bases of infected trees or stumps (Gilbertson and Ryvarden 1986), often in the autumn in Florida (Sinclair *et al.* 1987).



Fig. 2. White pocket rot caused by *Inonotus circinatus* in butt wood tissues of old growth *Pinus clausa*. (Photography credit: G. M. Blakeslee).



Fig. 3. Sporophores of *Inonotus circinatus* at the base of old growth sand pine. (Photography credit: E. L. Barnard).

EPIDEMIOLOGY: Inonotus root and butt rot infections are initiated through airborne basidiospores entering wounds in roots or tree bases and through vegetative (mycelial) growth of the pathogen from infected roots via root contacts or grafts (Whitney 1977). Progress of the disease following infection is typically slow; years may pass following initial infection and the appearance of symptoms (previously described). In infected pine stands, root disease foci may center on residual infected stumps or dead/dying trees. Such foci often display progressive symptom development and tree mortality radiating outward from the center of infection. Little is known about how long *I. circinatus* survives in the roots and butts of infected southern pines. Survival presumably varies with host tree species, local environmental conditions, and the prevalence and aggressiveness of competitive saprophytes. Survival for several years in certain situations could be expected.

DISEASE MANAGEMENT: Specific management guidelines for Inonotus root and butt rot of southern pines are not available. Awareness of the disease is helpful so as to avoid unnecessary and ineffective responses. The practice of good silviculture, including strategies to minimize fusiform rust infections in slash pine plantations and considering “pathological rotations” [*i.e.*, harvesting cycles based on ages at which disease related losses become critical; (Meinecke 1916)] in mature pine stands is recommended.

SURVEY AND DETECTION: Look for crown-thinning, basal resinosis, windthrow and pockets of tree mortality, especially in older pine stands. Diagnosis is enhanced by the occurrence of brownish, poroid basidiocarps at or near the base(s) of infected trees and stumps. Laboratory confirmation is aided by isolation of the fungus from symptomatic host tissues and/or the presence of hooked setae in the hymenia of the basidiocarps.

LITERATURE CITED

- Barnard, E.L., G.M. Blakeslee, J.T. English, S.W. Oak, and R.L. Anderson. 1985.** Pathogenic fungi associated with sand pine root disease in Florida. *Plant Disease* 69: 196-199.
- Barnard, E.L. 1988.** Phytophthora root rot of sand pine. Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Gainesville. *Plant Pathology Circular* No. 314. 4 p.
- Barnard, E.L., S.P. Gilly, and W.N. Dixon. 1991.** Incidence of *Heterobasidion annosum* and other root-infecting fungi in residual stumps and roots in thinned slash pines in Florida. *Plant Disease* 75: 823-828.
- Barnard, E.L. and J.R. Meeker. 1995.** *Leptographium* root infections of pines in Florida. Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Gainesville. *Plant Pathology Circular* No. 369. 3 p.
- Barnard, E.L. 1999.** Annosum root rot of pines in Florida. Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Gainesville. *Plant Pathology Circular* No. 398. 5 p.
- Blakeslee, G.M. and S.W. Oak. 1980.** Residual naval stores stumps as reservoirs of inoculum for infection of slash pines by *Phaeolus schweinitzii*. *Plant Disease* 64: 167.
- Boyce, J.S. 1961.** Forest pathology. 3rd edition. McGraw-Hill Book Company. New York. 572 p.
- Boyce, J.S., Jr. 1963.** Red root and butt rot in a Georgia slash pine plantation. *Plant Disease Reporter* 47: 572-573.
- Boyce, J.S., Jr. 1965.** *Polyporus tomentosus* in pine plantations at Athens, Georgia. *Plant Disease Reporter* 49: 322.
- Boyce, J.S., Jr. 1967.** Red root and butt rot in planted slash pines. *Journal of Forestry* 65: 493-494.
- Farr, D.F., G.F. Bills, G.P. Chamuris, and A.Y. Rossman. 1989.** Fungi on plants and plant products in the United States. American Phytopathological Society. St. Paul, MN. 1252 p.

Gilbertson, R.L., and L. Ryvarde. 1986. North American polypores. Vol. I. Fungiflora. Oslo, Norway. 433 p.

Hanula, J.L., J.R. Meeker, D.R. Miller, and E.L. Barnard. 2002. Association of wildfire with tree health and numbers of pine bark beetles, reproduction weevils, and their associates in Florida. *Forest Ecology and Management* 170: 233-247.

Meinecke, E.P. 1916. Forest pathology in forest regulation. U.S. Department of Agriculture Bulletin No. 275. 63 p.

Patton, R.F., and D.T. Myren. 1970. Root rot induced by *Polyporus tomentosus* in pine and spruce plantations in Wisconsin. pp. 167-170. *In: Root Diseases and Soilborne Pathogens.* T.A. Toussoun, R.V. Bega, and P.E. Nelson, (eds.). University of California Press. Berkeley. 252 p.

Sinclair, W.A., H.H. Lyon, and W.T. Johnson. 1987. Diseases of trees and shrubs. Cornell University Press. Ithaca, NY. 574 p.

Whitney, R.D. 1977. *Polyporus tomentosus* root rot of conifers. Canadian Forest Service, Forestry Technical Report 18. 12 p.